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Research Notes : Evaluation of soybean germplasm for resistance to corn earworm--IV

J. M. Joshi
University of Maryland Eastern Shore

UNIVERSITY OF MARYLAND, EASTERN SHORE
Soybean Research Institute
Princess Anne, MD 21853

1) Evaluation of soybean germplasm for resistance to corn earworm--IV.*

Corn earworm (Heliothis zea-Boddie) is one of the most destructive pests of soybeans (Glycine max [L.] Merrill). It feeds on foliage as well as developing pods. Each larva is capable of damaging 6 to 8.2 pods or 7.1 seeds between 4th to 6th instar (both inclusive) (Boldt et al., 1975; Smith and Bass, 1972). Some cultivars have been found to be resistant to foliage feeding by corn earworm (Beland and Hatchett, 1976; Clark et al., 1972; Joshi, 1977; Joshi and Wutoh, 1976; Hatchett et al., 1976) but to date no cultivar has been reported to resist pod damage from this pest. This study was undertaken to evaluate the extent of pod damage from corn earworm on certain soybean cultivars.

Materials and methods: Twenty-one soybean cultivars belonging to Maturity Group IV were evaluated for pod damage resistance during 1974 and 1975 in the screen house at the University of Maryland, Eastern Shore, Princess Anne. Ten seeds of each cultivar were sown on May 14 in both years, the seeds being 5 cm apart within the row and rows being 91 cm apart. Each cultivar was replicated 3 times. During 1974, 271 corn earworm moths were released in the screen house but in 1975, 416 moths were released in the same area. At maturity a random sample of 5 plants was taken from each cultivar. The number of damaged and undamaged pods/plant was recorded for each cultivar. Duncan's Multiple Range Test was used to test significant difference between the means.

Results and discussion: The mean numbers of undamaged and damaged pods/plant for each cultivar are given in Table 1.

During 1974, 'Oksoy' produced the highest number of undamaged pods/plant (45.4), followed closely by 'Custer' (44.4) and 'Columbus' (42.1). 'Funk Delicious', 'Boone', 'Carlin', 'Polysoy' and 'Cutler' produced significantly fewer pods/plant as compared with the rest of the cultivars. In 1975, Oksoy again produced the highest number of undamaged pods/plant (83.4) and the distant second was Columbus (43.7). Custer did not perform well in 1975. This may be due to increased insect pressure on the host plants during 1975.

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Table 1

Mean number of undamaged and damaged pods/plant for certain soybean cultivars

Cultivar	Undamaged pods		Damaged pods	
	1974	1975	1974	1975
Funk Delicious	6.5a*	9.0ab	0.7ab	0.1a
Boone	6.7a	5.0ab	0.2ab	0.5a
Carlin	7.8ab	21.2a-c	0.5ab	0.7a
Polysoy	12.2a-c	9.4ab	0.03a	1.3a
Cutler	15.1a-d	0.5ab	2.4b-d	2.6a
Midwest	18.9a-e	16.7a-c	2.5b-d	0.2a
Jefferson	20.8a-e	15.4a-c	1.8a-d	0.5a
AK (FC 30.761)	22.7a-e	13.8a-c	0.2ab	3.9a
Hurrelbrink	23.2a-e	17.9a-c	0.5ab	1.2a
Patterson	24.9a-e	22.9a-c	1.3a-c	3.0a
H.P. 963	27.7a-e	13.7a-c	1.0a-c	1.2a
Delmar	28.0a-e	17.7a-c	4.6e	0.5a
Wye	30.6a-e	26.5b-d	1.4a-c	3.1a
Emperor	32.7a-e	14.1a-c	3.0c-e	1.5a
Hong Kong	32.8a-e	4.1a	1.5a-d	0.6a
Kent	35.3b-e	17.9a-c	3.7de	1.1a
D67-3297	36.1c-e	33.1cd	1.1a-c	1.5a
AK (Kansas)	38.4c-e	20.1a-c	1.2a-c	0.6a
Columbus	42.1de	43.7d	1.2a-c	2.8a
Custer	44.4e	15.4a-c	2.0a-d	0.5a
Oksoy	45.4e	83.4e	1.7a-d	1.5a

*Means not followed by the same letter differ statistically at the 0.05 probability level according to Duncan's Multiple Range Test.

The number of corn earworm moths released during 1975 was 1-1/2 times more than in 1974 for the same area. Out of 21 cultivars, the productivity of 17 cultivars (Table 1) decreased due to increased pest pressure but the productivity of 4 cultivars (Funk Delicious, Carlin, Columbus and Oksoy) increased

in 1975 as compared with 1974. Based on two-year average, Oksoy produced the highest number of pods/plant (64.4), followed by Columbus (42.9) and D67-3297 (34.6). These data indicated that Oksoy exhibited a high level of tolerance to corn earworm.

More damaged pods on a cultivar is a clear indication of host preference by the corn earworm. Then it follows that percent pod damage can be used as an index to express preference or non-preference by this pest. On the basis of two-year average, it appears that Oksoy (3% damaged pods) and AK (Kansas) were least preferred by corn earworm, followed closely by Custer and D67-3297 (3.5% damaged pods/plant). The data indicate that Cutler was highly preferred by corn earworm for pod damage in the screen house. Research workers engaged in host plant resistance research may want to examine some of these entries more critically for developing resistant soybean cultivars.

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J. M. Joshi

2) Performance of soybeans, lima beans, and corn in pure and mixed culture.*

One of the main objectives of the National Aeronautics and Space Administration (NASA) is to develop a controlled ecological life support system (CELSS). Such a system is needed to harness solar energy for inhabitants of

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the earth and to set up manufacturing facilities in space. Before this gigantic step, NASA is interested in evaluating ground-based manned demonstration of CELSS (Mason and Carden, 1979). Higher plants will form one of the important components of CELSS. These plants will not only provide food and feed but also will play an important part in revitalizing air by removing CO_2 and adding O_2.

It has been reported that roots of certain plants exude certain chemical compounds which may depress the yielding ability of other crops when grown in close proximity. On the other hand, leguminous plants are known to exert beneficial effects on other crops growing close by.

Previous studies conducted for NASA clearly indicate the usefulness of soybean plant (Glycine max [L.] Merrill) in the development of CELSS (Phillips, 1977; Phillips et al., 1978). It has been suggested that 43% of the cropped area in the manufacturing facility in space be planted under soybeans (Phillips, 1977).

The objective of this study was to test compatibility of growing soybeans in mixed culture with corn (Zea mays) and lima beans (Phaseolus lunatus).

Materials and methods: Soybean cultivar 'Shore' was tested for its compatibility with corn ('6693 Pioneer') and lima beans (cultivar 'Henderson') in mixed culture in the field during 1978. The following treatments were evaluated:

1) soybeans in pure stand.
2) lima beans in pure stand.
3) corn in pure stand.
4) soybeans and corn in mixed culture (alternate rows).
5) soybeans and lima beans in mixed culture (alternate rows).

The experiment was laid out in a completely randomized block design with three replications. All treatments were planted on June 20, 1978. Each treatment consisted of four rows, rows being 6.1 m long and 0.9 m apart. Two center rows were treated as experimental rows. Sixty-one centimeter row length from each side in the experimental rows was treated as non-experimental, leaving 4.9 m as net experimental row length. Within the rows, corn seed was planted 20 cm apart, lima beans 8 cm apart and soybeans 4 cm apart. At maturity, two center rows of each treatment were harvested and seed yield was recorded. Seed yield is reported on the basis of single rows for all treatments. Lima beans were harvested on September 25 and 26, 1978; corn and soybeans were harvested on November 9, 1978. Data were analyzed statistically by

employing Duncan's Multiple Range Test.

Results and discussion: Yields from soybeans, lima beans and corn in pure and mixed stand are given in Table 1. These crops gave much higher yields in mixed culture than in pure stand. Soybean yield in pure stand was 497 g, but in mixed stand with corn, yield increased to 740 g. Though this increase in yield is quite substantial, the difference between these two treatments was not statistically significant. Soybeans in mixed culture with corn (alternate rows) appeared to have gained more height as compared to pure stand. The beneficial effect on soybean yield in mixed culture with corn may be due to increased plant height. Another factor which could have stimulated soybean yield might be moderation of extreme temperatures exerted by shading during day time.

Table 1
Yield of soybeans, lima beans and corn
in pure and mixed stand

Treatment	Yield/4.9 m row (g)
Soybean yield	
Pure stand	497.0a†
Mixed cultures with corn (alternate rows)	740.2ab
Mixed cultures with lima beans	1,051.0b
Lima bean yield	
Pure stand	202.3a
Mixed cultures with soybeans	374.8b
Corn yield	
Pure stand	1,024.2a
Mixed cultures with soybeans	2,253.0b

†Means not followed by the same letter differ at the 0.05 probability level according to Duncan's Multiple Range Test (DMR). DMR Test was applied to each crop separately.

Soybean in mixed culture with lima beans gave highest yield (1051 g). Since both of these crops are leguminous, it appears that they exert a beneficial influence on each other. It may be noted that lima beans in pure stand gave considerably low yield (202 g). Similar results have been obtained with corn.

When different kinds of organisms benefit from a mutual association, the relationship between the organisms is called mutualism. These data clearly indicate mutualistic relationship between soybeans, lima beans, and corn. Mixed cropping seems to be a useful practice to follow for producing food and feed in the space colonies. This approach may also be useful in terrestrial agriculture from the standpoint of energy conservation in developed countries and limited availability of energy inputs in less developed countries.

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J. M. Joshi
Brenda L. Spence

SEED RESEARCH LABORATORY
Beltsville Agricultural Research Center
Beltsville, MD 20705

1) Isolation of soybean lectin specific polysomes by immunoadsorption.

Soybean lectin (SBL), a glycoprotein found in seeds, is capable of agglutinating red blood cells. SBL has a molecular weight of 120,000 daltons and is composed of four subunits of 30,000 daltons (Lis and Sharon, 1973). SBL protein comprises 0.5-5% of the total protein in defatted meal, depending upon the soybean variety used (Pull et al., 1978). The present report describes the isolation of SBL-specific polysomes from the cotyledons of maturing seed by